

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark
Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 21 January 1997 (21.01.97)	
International application No. PCT/GB96/01330	Applicant's or agent's file reference M95/0385/PCT
International filing date (day/month/year) 04 June 1996 (04.06.96)	Priority date (day/month/year) 10 June 1995 (10.06.95)
Applicant GAILEY, Robert, McNaught et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

02 January 1997 (02.01.97)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer G. Bähr</p> <p>Telephone No.: (41-22) 730.91.11</p>
--	---

PATENT COOPERATION TREATY

PCT

23 JUL 1997

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference M95/0385/PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB 96/ 01330	International filing date (day/month/year) 04/06/1996	Priority date (day/month/year) 10/06/1995
International Patent Classification (IPC) or national classification and IPC B29C55/06		
Applicant J. & P. COATS, LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


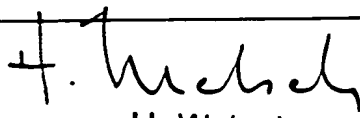
2. This **REPORT** consists of a total of five sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consists of a total of _____ sheets.

3. This report contains indications and corresponding pages relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 02/01/1997	Date of completion of this report 18.07.97
Name and mailing address of the IPEA:  European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Authorized officer  H. Weisch Telephone No. 2399.2307

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

Intern. application No.

PCT/GB96/01330

I. Basis of the report

1. This report has been drawn up on the basis of (Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.):

☒ the international application as originally filed.

☐ the description, pages _____, as originally filed,
pages _____, filed with the demand,
pages _____, filed with the letter of _____,
pages _____, filed with the letter of _____.

☐ the claims, Nos. _____, as originally filed,
Nos. _____, as amended under Article 19,
Nos. _____, filed with the demand,
Nos. _____, filed with the letter of _____,
Nos. _____, filed with the letter of _____.

☐ the drawings, sheets/fig _____, as originally filed,
sheets/fig _____, filed with the demand,
sheets/fig _____, filed with the letter of _____,
sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☐ the description, pages _____.

☐ the claims, Nos. _____.

☐ the drawings, sheets/fig _____.

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

Intern. application No.

PCT/GB96/01330

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims 5-15, 17-25, 27-31, 33-45_____	YES
	Claims 1-4, 16, 26, 32_____	NO
Inventive Step (IS)	Claims _____	YES
	Claims 5-15, 17-25, 27-31, 33-45_____	NO
Industrial Applicability (IA)	Claims 1-45_____	YES
	Claims _____	NO

2. CITATIONS AND EXPLANATIONS

1.1 Documents US,A,3 560 141 (D1) and US,A,3 646 747 (D2) disclose a method for making a strand material comprising drawing and twisting a tape of drawable material (concerning D2 it is particularly pointed to col. 1, lines 56 to 58: the speed of the take-up means can be 10% higher than the speed of the ribbon feeding means, i.e. the ribbon/tape is drawn).

Consequently, the subject-matter of claim 1 lacks novelty contrary to Article 33(2) PCT.

1.2 The features specified in dependent claims 2 to 4 in combination with the features contained in claim 1 are also known from documents D1 and D2. Therefore, the subject-matter of claims 2 to 4 also lacks novelty.

1.3 The features of dependent claims 5 to 15 relate to details of specific embodiments, which details are either

matters of common practice or obvious in view of the cited prior art - see documents D1 and D2.

2. The explanations given under point 1. apply mutatis mutandis to the subject-matter of claims 16 to 25. (Concerning these claims it is also pointed to document US,A,3 782 088 (D3) which also discloses most of their features.)
- 3.1 a) A strand material comprising a drawn tape of drawable material curled around its lengthwise direction so as to have a spiral cross section is known from document WO,A,95 06558 (D4) - see particularly Fig. 2 of this document.

b) A strand material comprising a coiled tape having in cross-section an inner spiral of one hand, a diametral bar, and an outer spiral of opposite hand is disclosed in Document EP,A,0 432 272 (D5) - see particularly Fig. 9(c) of this document.

Therefore, the subject-matter of claims 26 and 32 is not new.

- 3.2 The features of dependent claims 27 to 31 and 33 to 38 are either known from the state of the art cited in the Search Report or come within the scope of customary practice.
4. In view of the explanations under point 3. there is no basis for claims 39 to 45 directed towards the normal use of the products according to claims 26 to 38.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

Intern. application No.

PCT/GB96/01330

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

1. The reference numbers relating to Fig 10 (see page 14) appear to be partly wrong.

INTERNATIONAL SEARCH REPORT

Int. Application No

PCT/GB 96/01330

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B29C55/06 D02G1/02 D02G1/08 D01D5/253

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B29C D02G D01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,3 560 141 (KURILLA JOHN) 2 February 1971 see column 3, line 67 - column 4, line 25 see column 5, line 6 - line 9; figures ---	1-12, 16-31, 37-43
X	US,A,3 646 747 (STROHMAIER ALFRED J) 7 March 1972 see the whole document ---	1-12, 16-31, 37-43
X	US,A,3 782 088 (BAKEWELL D) 1 January 1974 see column 4, line 56 - line 67; figure 3 --- -/--	16-25



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

20 September 1996

Date of mailing of the international search report

09.10.96

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Attalla, G

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 96/01330

C(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,95 06558 (COATS VIYELLA PLC ;GAILEY ROBERT MCNAUGHT (GB); OGLESBY STANLEY (G) 9 March 1995 cited in the application	16
A	see figures 2-4,6 ---	39-43
X	PATENT ABSTRACTS OF JAPAN vol. 016, no. 269 (C-0952), 17 June 1992 & JP,A,04 065544 (TORAY IND INC), 2 March 1992, see abstract ---	26
X	EP,A,0 432 272 (OTSUKA KAGAKU KK) 19 June 1991 see column 6, line 9 - line 14; figure 9C ---	32-38
A	PATENT ABSTRACTS OF JAPAN vol. 011, no. 262 (C-442), 25 August 1987 & JP,A,62 062907 (KURARAY CO LTD), 19 March 1987, see abstract ---	33-35
A	WO,A,93 11931 (GAILEY ROBERT MCNAUGHT) 24 June 1993 see abstract ---	9
A	GB,A,2 060 010 (MACKIE & SONS LTD J) 29 April 1981 see abstract -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. onal Application No
PCT/GB 96/01330

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-3560141	02-02-71	GB-A- 1061916	
US-A-3646747	07-03-72	BE-A- 754196	31-12-70
US-A-3782088	01-01-74	CA-A- 957216	05-11-74
WO-A-9506558	09-03-95	AU-A- 7504094	22-03-95
		EP-A- 0719205	03-07-96
EP-A-0432272	19-06-91	DE-D- 69019120	08-06-95
		DE-T- 69019120	26-10-95
		US-A- 5462778	31-10-95
		CA-A- 2034003	10-12-90
		WO-A- 9015193	13-12-90
WO-A-9311931	24-06-93	AU-A- 3092092	19-07-93
GB-A-2060010	29-04-81	NONE	

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION CONCERNING
SUBMISSION OF PRIORITY DOCUMENTS

(PCT Administrative Instructions, Section 411)


To:

McNEIGHT, David, Leslie
McNeight & Lpiorce
Regent House
Heaton Lane
Stockport, Cheshire SK4 1BS
ROYAUME-UNI

Date of mailing (day/month/year) 16 July 1996 (16.07.96)		
Applicant's or agent's file reference M95/0385/PCT		IMPORTANT NOTIFICATION
International application No. PCT/GB96/01330	International filing date (day/month/year) 04 June 1996 (04.06.96)	Priority date (day/month/year) 10 June 1995 (10.06.95)
Applicant J. & P. COATS, LIMITED et al		

The applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to the following application(s):

<u>Priority application No.:</u>	<u>Priority date:</u>	<u>Priority country:</u>	<u>Date of receipt of priority document:</u>
9511836.0	10 Jun 1995 (10.06.95)	GB	15 Jul 1996 (15.07.96)
9519182.1	20 Sep 1995 (20.09.95)	GB	15 Jul 1996 (15.07.96)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer G. Bähr  Telephone No.: (41-22) 730.91.11
---	---

Form PCT/AB/304 (July 1992)

001156032

PATENT COOPERATION TREATY

PCT

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

McNEIGHT, David, Leslie
McNeight & Lawrence
Regent House
Heaton Lane
Stockport, Cheshire SK4 1BS
ROYAUME-UNI

Date of mailing (day/month/year) 27 December 1996 (27.12.96)		IMPORTANT NOTICE	
Applicant's or agent's file reference M95/0385/PCT			
International application No. PCT/GB96/01330	International filing date (day/month/year) 04 June 1996 (04.06.96)	Priority date (day/month/year) 10 June 1995 (10.06.95)	
Applicant J. & P. COATS, LIMITED et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AT,AU,BR,CA,CN,CZ,DE,EP,FI,GB,IL,JP,KP,KR,NO,NZ,PL,RO,SK,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
AL,AM,AP,AZ,BB,BG,BY,CH,DK,EA,EE,ES,GE,HU,IS,KE,KG,KZ,LK,LR,LS,LT,LU,LV,MD,MG,MK,
MN,MW,MX,OA,PT,RU,SD,SE,SG,SI,TJ,TM,TR,TT,UA,UG,UZ,VN

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
27 December 1996 (27.12.96) under No. WO 96/41714

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 730.91.11

Form PCT/IB/308 (July 1996)

1341627

PATENT COOPERATION TREATY

PCT

INFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

From the INTERNATIONAL BUREAU

To:

McNEIGHT, David, Leslie
McNeight & Lawrence
Regent House
Heaton Lane
Stockport, Cheshire SK4 1BS
ROYAUME-UNI

Date of mailing (day/month/year)
21 January 1997 (21.01.97)

Applicant's or agent's file reference
M95/0385/PCT

IMPORTANT INFORMATION

International application No.
PCT/GB96/01330

International filing date (day/month/year)
04 June 1996 (04.06.96)

Priority date (day/month/year)
10 June 1995 (10.06.95)

Applicant
J. & P. COATS, LIMITED et al

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP : KE, LS, MW, SD, SZ, UG

EP : AT, BE, CH, DE, DK, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

National : AT, AU, BG, BR, CA, CN, CZ, DE, FI, GB, HU, IL, JP, KP, KR, MN, NO, NZ, PL, RO, RU, SE, SK, US, VN

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

OA : BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG

National : AL, AM, AZ, BB, BY, CH, DK, EE, GE, IS, KE, KG, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MW, MX, PT, SD, SG, SI, TJ, TM, TR, TT, UA, UG, UZ

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of the annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent including, where applicable, ES which cannot be elected since it is not bound by Chapter II.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer:

G. Bähr

Telephone No. (41-22) 730.91.11

Form PCT/IB/332 (July 1996)

1364925

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

McNEIGHT, David Leslie
McNEIGHT & LAWRENCE
Regent House
Heaton Lane
STOCKPORT, CHESHIRE SK4 1BS
GRANDE BRETAGNE

NOTIFICATION OF RECEIPT
OF DEMAND

(PCT Rule 61.1(b), first sentence
and Administrative Instructions, Section 601)

Date of mailing
(day/month/year)

14. 01. 97

Applicant's or agent's file reference

M95/0385/PCT

IMPORTANT NOTIFICATION

International application No.

PCT/GB 96/ 01330

International filing date (day/month/year)

04/06/1996

Priority date (day/month/year)

10/06/1995

Applicant

J. & P. COATS, LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

02/01/1997

2. This date of receipt is:

- ☒ the actual date of receipt of the demand.
☐ the date on which the proper corrections to the demand were timely received.

3. ☐ This date is AFTER the expiration of 19 months from the priority date.

Attention: The election(s) made in the demand does (do) not have the effect of postponing the commencement of the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22).

For details, see Annex B to Form PCT/IB/301 sent by the International Bureau and Volume II of the PCT Applicant's Guide.

- ☐ This notification confirms the information given in person or by telephone on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA:



European Patent Office
D-80298 Munich
Tel. (+49-89) 2399-0, Tx: 523656 epmu d
Fax (+49-89) 2399-4465

Authorized officer

Boesenberg-Choust

-25 12

Telephone No.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic			SE	Sweden
CG	Congo	KR	Republic of Korea	SG	Singapore
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LR	Liberia	SZ	Swaziland
CS	Czechoslovakia	LT	Lithuania	TD	Chad
CZ	Czech Republic	LU	Luxembourg	TG	Togo
DE	Germany	LV	Latvia	TJ	Tajikistan
DK	Denmark	MC	Monaco	TT	Trinidad and Tobago
EE	Estonia	MD	Republic of Moldova	UA	Ukraine
ES	Spain	MG	Madagascar	UG	Uganda
FI	Finland	ML	Mali	US	United States of America
FR	France	MN	Mongolia	UZ	Uzbekistan
GA	Gabon	MR	Mauritania	VN	Viet Nam



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ :B29C 55/06, D02G 1/02, 1/08, D01D
5/253

A1

(11) International Publication Number:

WO 96/41714

(43) International Publication Date: 27 December 1996 (27.12.96)

(21) International Application Number: PCT/GB96/01330

(22) International Filing Date: 4 June 1996 (04.06.96)

(30) Priority Data:

9511836.0	10 June 1995 (10.06.95)	GB
9519182.1	20 September 1995 (20.09.95)	GB

(71) Applicant (for all designated States except US): J. & P. COATS, LIMITED [GB/GB]; 155 St. Vincent Street, Glasgow G2 5PA (GB).

(72) Inventors; and

(75) Inventors/Applicants (for US only): GAILEY, Robert, McNaught [GB/GB]; 35 Newtyle Road, Paisley, Renfrewshire PA1 3JX (GB). CURRAN, William, Wingate [GB/GB]; 16 Park Avenue, Paisley, Renfrewshire PA2 6HL (GB). AITKEN, John [GB/GB]; 17 Stanley Avenue, Paisley, Renfrewshire PA2 9LB (GB). GRAHAM, John [GB/GB]; 61 Thorndene, Elderslie, Renfrewshire PA5 9DD (GB).

(74) Agents: McNEIGHT, David, Leslie et al.; McNeight & Lawrence, Regent House, Heaton Lane, Stockport, Cheshire SK4 1BS (GB).

(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

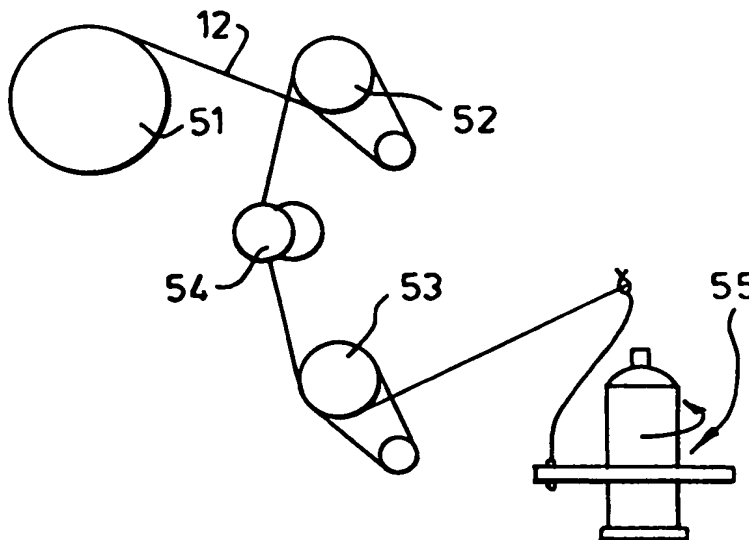
Published

With international search report.

(54) Title: STRAND MATERIAL

(57) Abstract

There is disclosed a method for making a strand material comprising drawing and twisting a tape (12) of drawable material.



- 1 -

STRAND MATERIAL

This invention relates to strand material and to methods and apparatus for making it.

In WO 95/06558 is disclosed a method for making strand material comprising drawing a laminar material having a first layer of drawable material and a second layer of elastically extensible material so that the first layer extends inelastically while the second layer extends elastically so that the drawn materials tends to curl into a coil strand configuration. Strands suitable for use as weaving, knitting and sewing threads may be made from e.g. a nylon or polyester tape coated with a polyurethane elastomer. A tape having a width of some 5mm with a pre-draw thickness of 12-14 microns, of which 2 microns will be the elastic layer, will draw down and curl into a filament - like form which is suitable for textile purposes.

The tendency to curl and remain curled is ascribed to a change in the relative widths of the substrate and elastic material after drawing, the elastic material having been reduced in width less than the substrate and so tending to an equilibrium position in which it lies on the outside of the curled formation.

WO 95/06558 describes two modes of coiling, namely a single spiral, in cross-section, and a "C" formation with each end of the "C" in the form of a tight spiral - this may be symmetric or asymmetric, with one coil being larger than the other.

- 2 -

The fact of the elastic coating layer being on the outside of the coil structure imposes some limitations on the choice of materials and also some limitations on the use to which the strand material may be put. It is desirable that, for regular textile usage, the strand - and thus the outer elastic material - have good abrasion resistance, be non-abrasive and be readily lubricated.

The outer layer is also thin and even though it may have good abrasion resistance, it is, on account of its thinness and its exposure, liable to being rubbed off together, of course, with any colour it carries.

The present invention provides novel strand material that does not suffer from these disadvantages, and which has other advantages over prior art strand materials, and also provides methods and apparatus for making such strand material.

The invention comprises a method for making a strand material comprising drawing and twisting a tape of drawable material.

The tape may be twisted whilst being drawn, and may be false twisted.

The tape may be homogeneous throughout its cross-section. This is surprising and a marked departure from previous proposals, where it has been deemed necessary to have a bicomponent tape, and indeed one, for best results, in which one component (a substrate) is of drawable material and the other (a coating) is of elastically extensible or elastomeric material.

- 3 -

Of course, a strand material produced with such a homogeneous or single component tape will not be the same in all respects as one from a bicomponent tape. However, while it may lack the degree of coiling and the permanence of some biocomponent materials, it is a useful product for a number of different end-users, and can be processed to enhance its properties, as by heat setting, which will tend to render permanent, or more permanent, the spiral cross-section configuration.

While strand material can be produced by false twisting the tape while it is being drawn, the result being a coiled tape strand with no twist, it is also possible that real twisting can be used whether together with or instead of false twisting, especially perhaps when bicomponent tapes are used when the real twisting will serve to initiate the spiral formation. Real twisting can be effected in a draw twisting arrangement. Whilst the twisting, real or false, is best effected contemporaneously with drawing, it is not excluded that with some materials the twisting can be carried out on a fully-drawn tape or totally-oriented tape, the twisting effecting the coiling which might then need to be set into permanency as for example by heating.

When the tape is a bicomponent tape, comprising a substrate and a coating, the coating may, as already proposed, be an elastomeric or elastically stretchable material, but the tape may be formed with a spiral cross-section with the coating on the inside of the spiral instead of the outside as taught in WO 95/06558.

The coating may be of a heat sealable material. It need not be elastically extensible and may be inelastically extensible. It may be of a heat seal adhesive such as

- 4 -

polyvinylacetate copolymer. Heat sealing will serve to increase or bring about permanence of the coiled configuration. Real twist may also contribute to permanence.

The coating may incorporate a dye which is transferred to the substrate, as by heating, the dye for such purposes possibly being a sublimable disperse dye and the strand material being heated to a temperature sufficient to sublime the dye.

The invention also comprises a method for making strand material in which a flat tape of drawable material is drawn and twisted to form a coiled tape.

The tape may be twisted in a draw zone, and may be false twisted.

False twisting may be effected by a friction false twist device, which may comprise a roller over which the tape runs with a non-trivial angle between the direction of travel of the tape and the direction of travel of the roller surface where the tape contacts it. The run of the tape may turn the roller, or the roller may be driven.

The effect of the twisting can be to produce the reversing spiral formation above-mentioned, though a monospiral and other configurations can also be produced.

The twisting initiates the coiling, though the width differential of a composite tape with an elastically extensible layer as aforementioned may operate to maintain the spiral formation against a tendency to relax over time. Because the width differential is no longer needed to initiate the coiling, it is possible to hot-draw the tape.

- 5 -

Among other advantages, the hot draw zone input roller can be used to dry a just-coated tape - the tape can be run elastomer side down on the hot roller.

As with WO 95/06558, the composite tape may be drawn to stabilise the drawable polymer within the elastic limit of the elastic material. The drawable polymer may have a natural draw ratio which is the smallest draw ratio at which it is stabilised but may be one that can be drawn substantially beyond its normal draw ratio, and doing this brings advantages in terms of strength and increased fineness.

The invention also comprises apparatus for processing a tape of a drawable polymer material comprising an arrangement for the supply of the tape, a drawing arrangement for the tape and twisting arrangement for the tape.

The supply arrangement may comprise a support for a roll of tape.

The drawing arrangement may comprise input and output roller means.

The twisting arrangement may comprise a false twisting arrangement, which may be located in the drawing arrangement so that false twist runs back to a twist stop therein which may be situated at input roller means thereof.

The false twisting arrangement may comprise a friction false twisting arrangement, which may comprise a roller, which may be a flanged roller, over which the tape is guided to run with a non-trivial angle between the direction of travel of the tape and the direction of travel of the roller surface where the tape contacts it. The term

- 6 -

“friction false twist device” is intended to encompass devices where there is relative sliding between the contacting surfaces as well as devices where the tape has a purely rolling motion over the roller surface. The roller may be free to be rotated by the tape as it runs over it, or it may be driven, which might give rise to a wider degree of control over the coiling operation.

Strand materials and methods and embodiments of apparatus for making them (and other strand materials) according to the invention will now be described with reference to the accompanying drawings, in which :

Figure 1 is a cross-section through a first strand material,

Figure 2 is a perspective view of second strand material with twist,

Figure 3 is a cross-section through third strand material,

Figure 4 is a diagrammatic illustration of a first embodiment of apparatus for strand production,

Figure 5 is a diagrammatic illustration of a second embodiment of apparatus for strand product, and

Figure 6 is a cross-section of a fourth strand material,

Figure 7 is a cross-section of a fifth strand material,

- 7 -

Figure 8 is a cross-section of a sixth strand material,

Figure 9 is a cross-section of a further strand material,

Figure 10 is a diagrammatic illustration of another apparatus for strand material production,

Figure 11 is a front elevation of a friction false twist wheel, and

Figure 12 is a side elevation of the wheel of Figure 11.

Figures 1 to 3 illustrate strand material 11 made by methods according to the invention comprising a drawn tape 12 which is or has been twisted.

The cross-section of the strand material in each case is spiral.

Figure 1 illustrates a strand material 11 made from a homogeneous, drawable tape which has been false twisted during the drawing step and which has, as a result, readily taken up the spiral cross-section form. It is possible to produce a similar structure even without false twisting, but the false twisting positively initiates the rolling-up action which may otherwise be uncertain.

As compared to strand materials produced according to WO 95/06558, the spiral configuration may have a lesser degree of permanence. This may not matter for

- 8 -

some applications, or if a higher degree of permanence is required it may be brought about in some other fashion.

One such fashion could involve the insertion of a degree of real twist as illustrated in Figure 2. This could be achieved on a draw twisting machine such as it illustrated in Figure 5, which shows a supply 51 of undrawn tape 12 feeding to a first godet 52 then to a second godet 53 running faster than the first to draw the tape, which runs over a false twist device 54 to initiate the rolling-up action. The strand material for the second godet 53, which contains up to that point no real twist, is taken up on a ring spindle 55 which inserts real twist which runs back to the second godet 53. Either or both godets 52, 53 may be heated and a draw pin, which may be a hot draw pin, is optional in the draw zone defined by godets 52, 53. Even a strand produced by false twisting without any real twisting can, however, give the appearance of having real twist inasmuch as the false twist can give rise to a twist-like surface irregularity evidently due to alternating sections of slight S and Z twist.

Strand material 11 without real twist may be made on similar equipment except, of course, for the ring spindle 55, which would be replaced by a cross-winding arrangement.

Figure 3 illustrates another way of imparting permanence, or greater permanence, to the spiral cross-section formation. In this case, the undrawn tape has been coated with a sealing material such as a polyvinylacetate copolymer adhesive 31 which is, after drawing and rolling-up inside the tape substrate 12. The strand material

- 9 -

only has to be heated to a suitable temperature for the adhesive to seal the coiled layers together.

Since the adhesive 31 is on the inside of the strand material 11, the outside of the strand is the material of the substrate which can be of any drawable polymeric material and which can, therefore, be selected to have properties appropriate to the end use intended for it such, for example, as abrasion resistance and dyeability - dyeing will not be precluded or hindered by the presence of an outer elastomeric layer as taught in WO 95/06558.

A novel method for colouring strand material may be practised with strand material as described with reference to Figure 3. Broadly, this method involves including within or on the strand material or within or on a component of it, a dye which can transfer with the body of the strand material.. Such a dye may be a sublimable disperse dye of the kind used in heat transfer printing and it may be transferred by heating to its sublimation point. However, acid and reactive dyes can be used, and, indeed, generally speaking, any dye can be used which is suitable for the material in question. In the strand material of Figure 3, the dye may be contained in the coating adhesive 31.

The material of Figure 3 may be made on apparatus as illustrated in Figure 4 in which a drawable tape 41 is fed from a supply reel 42 by forwarding up rollers 43 to an adhesive applicator device 44 in which adhesive 45 is picked up on a roller 46a and transferred to an applicator roller 45b in contact with which the tape 41 runs to godet 47a, then over false twist device 48 to godet 47b running faster than godet 47a to draw

- 10 -

the tape, which is coiled by the drawing action as initiated by the false twist device 48, the thus formed strand passing to a cross wind-up arrangement 49 comprising a godet 49a and wind-up head 49b.

Processing is facilitated by heat and/or moisture. Moisture can be applied by a lick roller to one side of the tape prior to coiling. While heated rollers have generally been described in connection with applying heat to the tape, when flat the tape is amenable to heating on a hot plate.

It is found in some circumstances to be advantageous to separate the twist point from the draw point - slipping contact with a roller immediately before the false twist wheel localises the draw point at the roller and the false twist runs back along the tape as far as, but not beyond, the draw point. It may be found advantageous, for example, to confine the twist to the last third, say, of the draw zone.

As described with reference to Figure 5, the godets 47a, 48c or either of them can be heated and a draw pin, which may be heated, is optional and would be used according to normal practice with the polymer material being processed.

If the adhesive contains a sublimable dye as described above, it may be arranged that any one of the heated elements referred to is at a temperature which will sublime the dye, or a special heated element may be added to that apparatus. Heat sealing and sublimation may be effected by the same heated element or by different elements as may be devised.

- 11 -

The real twist, of course, may be inserted in the strand material of Figure 3 as by an arrangement illustrated in Figure 5.

Depending on the nature and the amount of the heat seal adhesive employed, the strand material may be somewhat stiff for some purposes, but this can be usually be rectified by a softening treatment appropriate to the materials concerned.

As with the process of WO 95/06558, fibres or filaments may also be incorporated in the strand material, and single spiral or double spiral formations may be produced as well as cross-sections in which the inner part spirals one way and the outer part spirals the opposite way, the two parts being joined by a diametral bar. The strand materials may be made with or without a particulate filler such as titanium dioxide or zinc oxide, but the methods described herein facilitate the production of strand material without any filler and which can, therefore, be used as a sewing thread which does not require to be dyed as, being translucent it will pick up the colour of the surrounding fabric.

Figures 6 to 9 illustrate strand materials that can be made using the apparatus illustrated in Figure 10 and the methods for using the same described herein.

Figure 6 illustrates a strand material 11 similar to one that can be produced according to WO 95/06558, but which can be produced more readily and with improved properties as compared to prior art materials including those of WO 95/06558. The material 11 in cross-section comprises a monospiral of a two component film material

- 12 -

of which one component 12 is a substrate of a drawn film-forming synthetic polymer material and the other component 13 is a coating of an elastomer such as polyurethane.

The material is tightly coiled, with the elastomer 13 on the outside. The cross-section is greatly enlarged - the tape material from which it is produced is a few, say 5, millimetres wide, while the finished strand has a linear density of perhaps 200 decitex.

The strand material 21 of Figure 7 has a "C" shaped cross-section with strong tight spirals at the ends of the "C". Again, it is of a composite film material having a drawn polymer substrate 12 with an elastomer coating 13 thereon.

The material 31 of Figure 8 is like that of Figure 6 except for having additional spun filaments 32 contained within the spiral formation.

All of these materials, which resemble materials described in WO 95/06558, can be produced by the methods and apparatus which will be described with reference to Figure 10.

The strand material 91 illustrated in Figure 9, however, is new and illustrates an increased flexibility of production that is achievable using the novel methods and apparatus described herein.

The material 91 is, as before, of a drawn polymer film substrate 12 with an elastic coating 13, but has in cross section an inner spiral 92 of which the elastic coating

- 13 -

13 is on the outside, and then a reversal, producing a diametral bar 93 and an outer spiral 94 of opposite hand to the inner spiral 92. Thus the substrate 12, which can be of polymer such as nylon-6, nylon-6,6 or polyester with good textile properties such as dyeability and abrasion resistance, appears now on the outer surface of the strand material.

WO 95/06558 discusses incorporating fillers into the components of the strand material, the fillers comprising solid particulate material such as TiO_2 or gas or liquid inclusions which can modify the properties of the material. The same fillers, can, of course, be included in the materials described herein. Thus TiO_2 can be included as optical brightener, or zinc oxide could be included, giving brighter colours in colouring than TiO_2 . The strand material can have a shiny or a matt appearance, however, depending upon whether the elastic or the substrate layer is on the surface. A strand can, however, be produced which has no included material and which is translucent - such a strand, undyed, can be used as a sewing thread in coloured fabric where it will transmit the colour of the fabric - this will avoid the need to produce sewing threads of many different colours, although it might be preferred to produce threads in just a few colours which might more readily blend in with a similar but not exactly matching fabric.

Figure 10 illustrates the method and apparatus for producing threads as described with reference to Figures 1 to 9.

The apparatus comprises an arrangement 101 for the supply of a tape 102 - in fact, this Figure illustrates alternative such supplies A and B. Supply A is simply a support 103 for a roll 104 of bicomponent tape 102. Supply B is a coating arrangement

- 14 -

in which a nylon, polyester or like film material substrate 102b is supplied from a roll 104b to a coating arrangement 105 at which an aqueous suspension of a polyurethane, for example, is applied by a roller 106 from a bath 107 to form a bicomponent tape 102.

The tape 102 is supplied, elastic coating side up, a hot godet 108 to dry the coating, then coating side down, to an input feed roller arrangement 109 of a drawing arrangement which includes also an output roller arrangement 110 running at a higher surface speed than the arrangement 109. The input arrangement 109 is heated.

Between the input and output roller arrangements the tape passes over a flanged, free-running roller 111 arranged at such an angle that the tape receives a false twist that runs back to the input roller arrangement 108. The tape may need to be pretwisted by hand at start-up before being applied on to the roller 111. The coiled tape strand material 112 is wound up in a take-up arrangement 113, which comprises a godet 114 which together with the output godet 110 may be hot or cold, a lubrication applicator 115 and a wind-up bobbin 116.

The roller 111 could of course, be driven in rotation.

The idea is that the coiled up tape 102 rolls on or is perhaps slidably rotated by contact with the roller 111 so that a false twist is generated. Depending on the position and skewedness of the roller 111 in relation to the path of the strand between the input and output roller arrangements, one or other of the strands illustrated in Figures 6 to 9 will be produced. The strand of Figure 7 would normally be produced without the use of the roller 111 or with it set square-on rather than skewed. The addition of a drive

- 15 -

for the roller 111 instead of allowing it to rotate under the drag of the running strand may give better control to the extent that the disposition of the diametral bar 93 in relation to the inner and outer spirals of the strand material 91 of Figure 9 could be predetermined with accuracy.

Figure 11 and 12 illustrate a friction false twist wheel 121 suitable for false twisting tape in the methods and apparatus described with reference to Figures 1 to 10. The wheel 121 (48 in Figure 4, 54 in Figure 5, 61 in Figure 10) simply comprises a V-groove pulley type wheel made of a material such as polyurethane or rubber or at least having a surface of such material with which the material of the tape will have a suitable coefficient of friction. The tape (referenced 122 in these figures) is run in contact with a part of one conical face 123 of the V-groove 124. The wheel 121 is mounted conveniently for adjustment about two axes A, B orthogonal to each other and to the axis of rotation C of the wheel 121. It is perfectly satisfactory to let the wheel 121 rotate freely about axis C, but it could be driven, and this could give an extra element of control.

The required level of false twist is by no means as high as that which is required for false twist texturing multifilament yarns. A level of a few turns per centimetre is sufficient to exert the necessary control over the way the tape collapses into a spiral cross-section spill-like tube or rod.

Yarns produced by the methods and apparatus described and having the characteristics as described with reference to the various drawings depicting embodiments of the yarns have advantages over conventionally - produced threads.

- 16 -

For drape, whether of a textile fabric or a sewn seam in a textile fabric, the yarns are required to flex in a direction normal to the plane of the fabric, i.e. about an axis lying in the fabric at the point of flexure. The yarns described herein are relatively easily flattened locally, and such local flattening will enhance drapeability. If the yarn is used as a sewing thread, which is a primary interest of Applicant, flattening is brought about by pressure against the sewing needle at the high tension point of the sewing cycle. Sewn thread would be flattened so that its major cross-sectional axis lay in the plane of the fabric, thereby enhancing seam flexibility normal to the fabric. The thread would, however, be stiffer against bending in the plane of the fabric, and this would enhance the ability of the seam to remain straight.

Since the thread does not need to have any or any substantial degree of twist, it is suitable for multi-directional sewing and in particular for embroidery - in fact it has advantages over conventional twisted threads in this regard as it does not change its appearance on changing seam direction. On this account, also, it is advantageous in sewing tightly-woven fabrics such as air-bag fabrics, in which sewing using conventional twisted sewing thread is problematical.

Weaving would not ordinarily produce the requisite local forces to bring about flattening, but warp and weft crowns in a weave could be flattened by calendering, particularly with heat setting, and this would enhance drape while stiffening the fabric against distortion within the woven structure. In addition, weave interstices would be reduced, increasing the effective cover factor of the weaving yarns. With substantial reduction of weave interstices, filter fabrics and even wind-break fabrics could be produced.

- 17 -

Although not inherently as flexible as multifilament yarns normally used for knitting, weaving and sewing, the flexibility of the yarns according to the invention can be improved by moisture - storing the yarns in a moisture-controlled environment prior to use, or simply wetting them, will improve flexibility for sewing, weaving and knitting. Reducing the moisture content after fabrication will improve resistance to fabric distortion.

As sewing threads yarn produced according to the invention has improved abrasion resistance over multifilament sewing threads, the filaments of which break rapidly and progressively while the yarns of the invention remain unscathed under like treatment. This improved abrasion resistance will be of substantial benefit in connection with the manufacture of footwear, where normal sewing threads have to be used only in locations on the footwear where they are shielded from the possibility of abrasion.

The properties of yarns according to the invention are, when used as sewing threads, comparable with those of equivalent linear density bonded nylon sewing threads. Tenacity is approximately 15% lower than that of bonded nylon, but, strangely, seam tenacity is some 15% higher, in threads tested to date.

- 18 -

CLAIMS

1. A method for making a strand material comprising drawing and twisting a tape of drawable material.
2. A method according to claim 1, in which the tape is twisted whilst being drawn.
3. A method according to claim 1 and claim 2, in which the tape is false twisted.
4. A method according to any one of claims 1 to 3, in which the tape is homogeneous through its cross-section.
5. A method according to any one of claims 1 to 3, in which the tape comprises a substrate and a coating.
6. A method according to claim 5, in which the coating is of an elastomeric or elastically stretchable material and is formed into a spiral cross-section with the coating on the inside of the spirals.
7. A method according to claim 5, in which the coating is of a heat sealable material.

- 19 -

8. A method according to claim 5 and claim 6, in which the coating is not elastically extensible.
9. A method according to claim 8, in which the coating is inelastically extensible.
10. A method according to claim 7, in which the strand material is set by heat sealing the material of the coating.
11. A method according to claim 5 and claim 7, in which the coating is of a heat seal adhesive.
12. A method according to claim 11, in which the heat seal adhesive comprises polyvinylacetate copolymer.
13. A method according to any one claims 4 to 12, in which the coating incorporates a dye which is transferred to the substrate.
14. A method according to claim 13, in which the dye is transferred by heating.
15. A method according to claim 14, in which the dye is a sublimable disperse dye and the strand material is heated to a temperature sufficient to sublime the dye.

- 20 -

16. Apparatus for processing a tape of a drawable polymer material comprising an arrangement for the supply of the tape, a drawing arrangement for the tape and twisting arrangement for the tape.
17. Apparatus according to claim 16, in which the supply arrangement comprises a support for a roll of tape.
18. Apparatus according to claim 16 or claim 17, in which the drawing arrangement comprises input and output roller means.
19. Apparatus according to claim 18, in which the input roller means are heated.
20. Apparatus according to any one of claims 16 to 19, in which the twisting arrangement comprises a false twisting arrangement.
21. Apparatus according to claim 20, in which the false twisting arrangement is located in the drawing arrangement so that false twist runs back to input roller means thereof.
22. Apparatus according to claim 20 or claim 21, in which the false twisting arrangement comprises a friction false twist arrangement.
23. Apparatus according to claim 22, in which the friction false twisting arrangement comprises a roller over which the tape is guided to run with a non-trivial

- 21 -

angle between the direction of travel of the tape and the direction of travel of the roller surface where the tape contacts it.

24. Apparatus according to claim 23, in which the roller is free to be rotated by the tape as it runs over it.

25. Apparatus according to claim 24, in which the roller is driven.

26. A strand material comprising a drawn tape of drawable material curled around its lengthwise direction so as to have a spiral cross-section.

27. A material according to claim 26, in which the material of the tape has a homogeneous cross-section.

28. A material according to claim 27, in which the tape when uncurled has a width less than 5mm and when curled has a diameter less than 1mm.

29. A material according to any one claims 26 to 28, in which the tape has no or substantially no real twist.

30. A material according to any one of claims 26 to 28, in which the tape has real twist which is set.

31. A material according to any one of claims 26 to 30, in which the tape is drawn to a higher than normal draw ratio.

- 22 -

32. Strand material comprising a coiled tape having in cross-section an inner spiral of one hand, a diametral bar, and an outer spiral of opposite hand.
33. Strand material according to claim 32, of bicomponent tape comprising a substrate and a coating.
34. Strand material according to claim 33, in which the coating is of an elastomeric material.
35. Strand material according to claim 33 or claim 34, in which the substrate is on the outside of the outer spiral.
36. Strand material according to any one of claims 33 to 35, in which the substrate is of a polymer such as nylon-6, nylon-6,6. or polyester.
37. Strand material according to any one of claims 26 to 36, comprising additional spun filament material.
38. Strand material according to claim 37, in which the filament material is contained within the cross-section of the coiled tape.
39. Strand material according to any one of claims 26 to 38, adapted for use as a weaving, knitting or sewing thread.

- 23 -

40. A knitted fabric comprising yarn of strand material according to any one of claims 26 to 39.
41. A woven fabric comprising yarn of strand material according to any one of claims 26 to 39.
42. A woven fabric according to claim 41, in which the yarns at the warp and weft crowns have been flattened by pressure to enhance the drapeability of the fabric.
43. A fabric, garment or other artefact sewn with a sewing thread comprising a strand material according to any one of claims 26 to 39.
44. A method of processing strand material according to any one of claims 26 to 39 by knitting, weaving, sewing, texturing or any other process in which the material is subject to flexure in which the material is softened by heat and/or moisture during such processing to increase its flexibility.
45. A seam in a fabric having differential flexibility due to a sewing thread used in the seam being of monofilament structure as by being a strand according to any one of claims 26 to 39 and being capable of cross-sectional deformation having become deformed in the seam so that its major cross-section lies in the plane of the fabric at the seam.

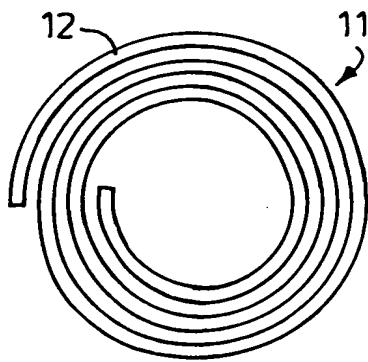


FIG. 1

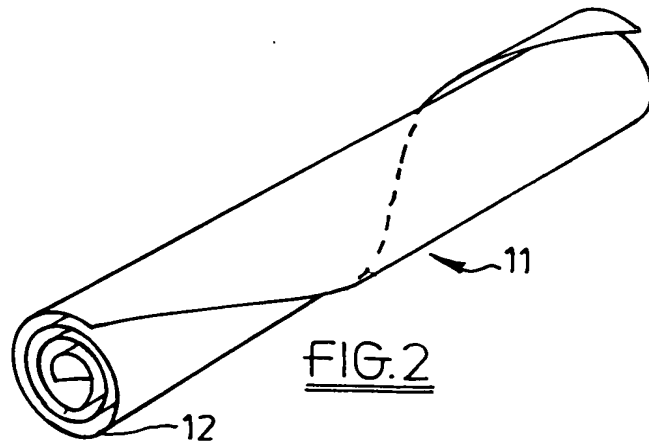


FIG. 2

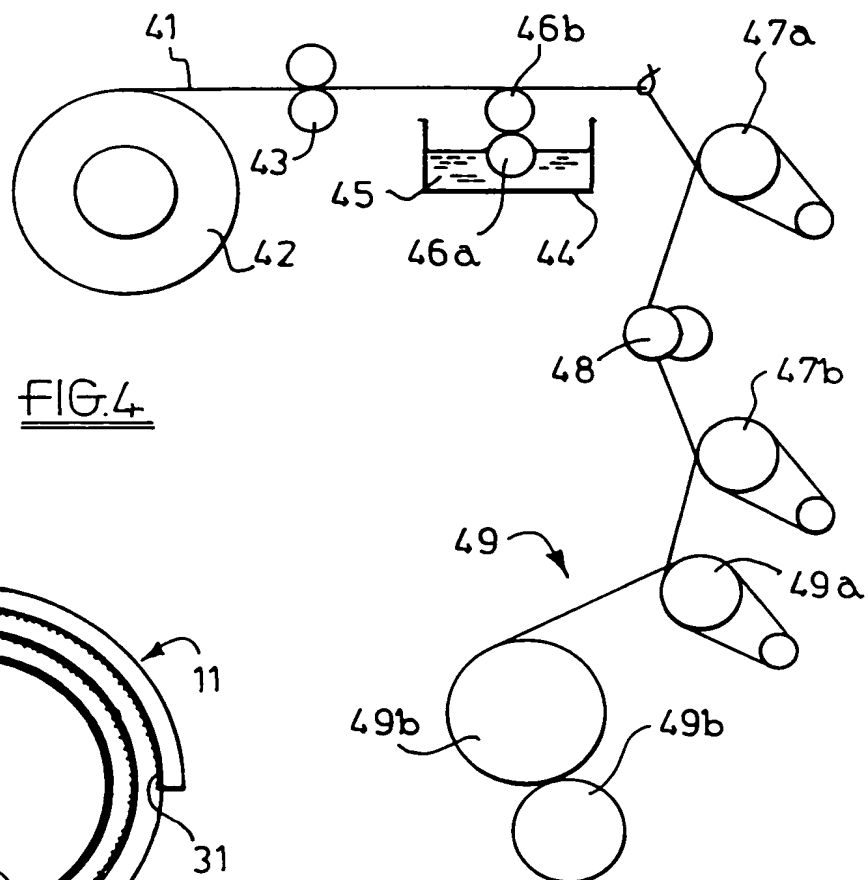


FIG. 4

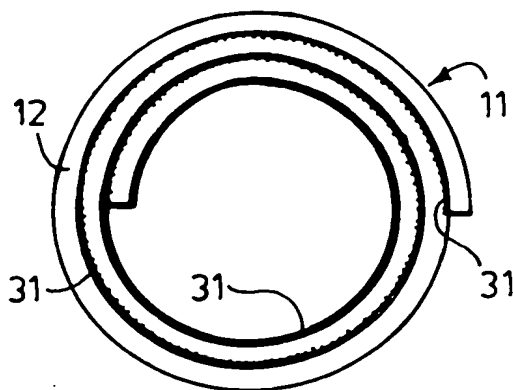


FIG. 3

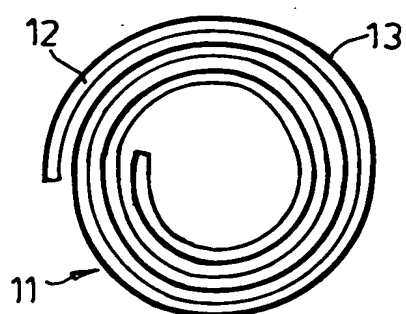


FIG. 6

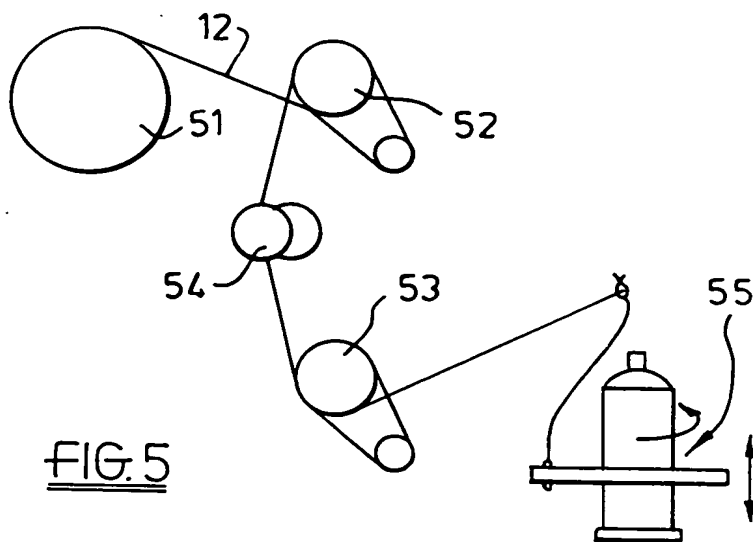


FIG. 5

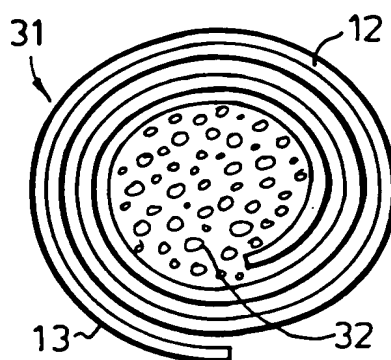


FIG. 8

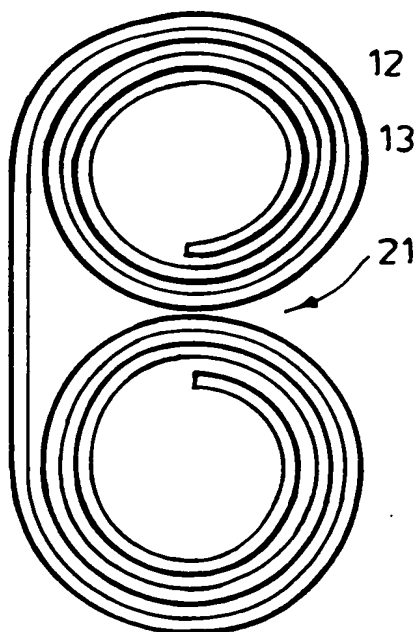


FIG. 7

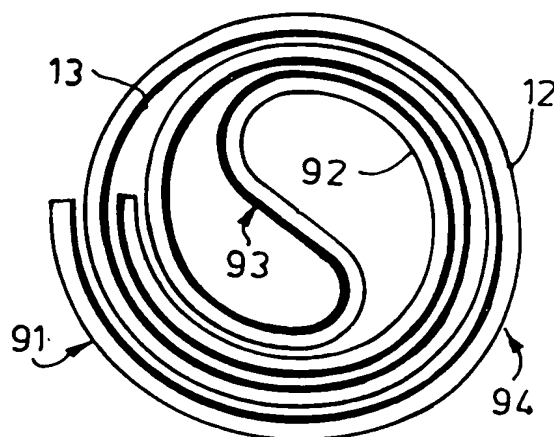


FIG. 9

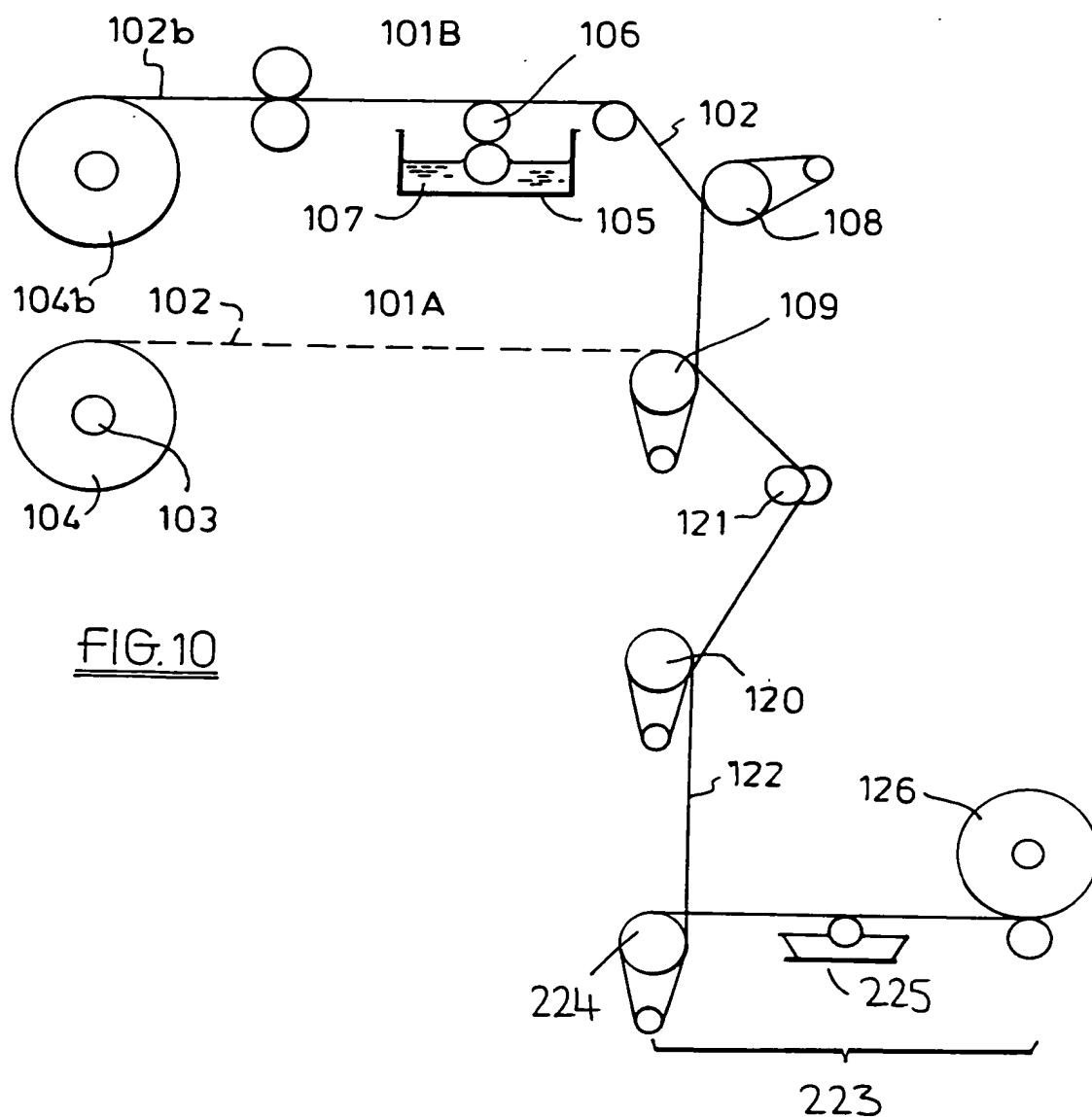


FIG. 10

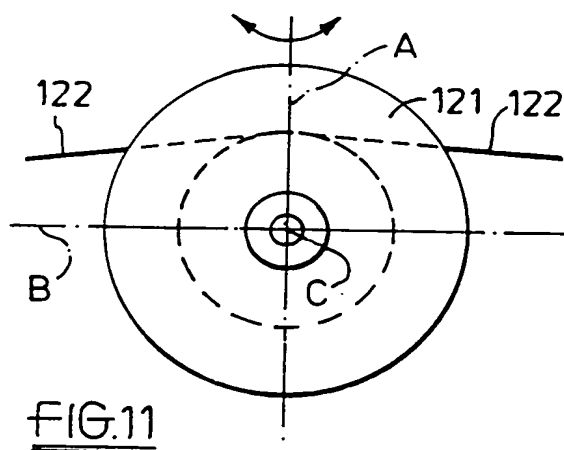


FIG. 11

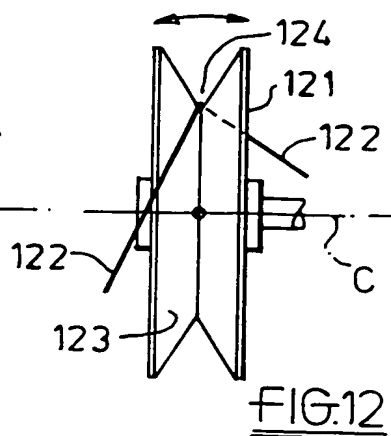


FIG. 12